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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/055,157	10/22/2001	Bih-Tiao Lin	JCLA4827-CIP	8975

7590 09/10/2002

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EXAMINER

MAI, ANH D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 09/10/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/055,157

Applicant(s)

LIN ET AL.

Examiner

Anh D. Mai

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 October 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/371,678.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

1. Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification as well as the claims, discloses an oxide deposition, HDP-CVD, process that fills a trench or groove, having vertical side walls above the active regions.

The parameters as shown in the specification appears to be a normal setting of the apparatus.

Note that, argon gas is well known to be used in the HDP process as a sputter gas. The characteristic of argon sputter is 45°, thus a pyramid shapes are the well known feature of the HDP-CVD. The surface of the oxide layer will level off as more oxide is deposited.

All references are cited to show that “vertical” could not and should not form above the active regions as disclosed.

Note that, by controlling etch/deposit ratio, the result is avoid clipping of the corner and/or preventing void formation in side the trench.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

2. Claims 1-3, 5 and 6 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Walsh et al. (U.S. Patent No. 6,228,741).

With respect to claim 1, as best understood by the examiner, Walsh teaches a method for forming a shallow trench isolation structure as claimed including:

providing a substrate (10) comprising at least a trench (25) and an active region covered by a mask layer (20) and isolated by the trench (25);

forming an insulation layer (40) to fill the trenches (25) and to cover the mask layer (20) by HDP-CVD, wherein a surface of the insulation layer (40) formed over the trench (25) is higher than a surface of the substrate (10) and lower than a surface of the mask layer (20);

forming a thin film (50) on the insulation layer (40);

forming a screen layer (60) on the thin film (50) by a fluid precursor;

removing the screen layer (60) and the thin film (50) over the active region, while the screen layer (60) and the thin film (50) above the trenches are not removed;

removing the insulating layer (40) above the active regions to expose the mask layer (20);

removing the screen layer (60) to expose the thin film (50) above the trench (25);

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removing the thin film (50) above the trench (25) to expose the insulation layer (40); and removing the mask layer (20) above the active region. (See Figs. 1-9).

With respect to claim 2, the insulating layer (40) of Walsh includes a silicon oxide.

With respect to claim 3, the thin film (50) of Walsh includes a silicon nitride.

With respect to claims 5 and 6, the screen layer (60) of Walsh includes a spin-on-glass or a photoresist.

3. Claims 1-3, 6-10, 13-16, 19 and 20 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Kuehne et al. (U.S. Patent No. 6,146,975).

With respect to claim 1, Kuehne teaches a method for forming a shallow trench isolation structure as claimed including:

providing a substrate (21) comprising at least a trench (25) and an active region covered by a mask layer (23) and isolated by the trench;

forming an insulation layer (27) to fill the trenches (25) and to cover the mask layer (23) by HDP-CVD, wherein a surface of the insulation layer (27) formed over the trenches (25) is higher than a surface of the substrate (21) and lower than a surface of the mask layer (23);

forming a thin film (31) on the insulation layer (27);

forming a screen layer (33) on the thin film by a fluid precursor;

removing the screen layer (33) and the thin film (31) over the active region, while the screen layer (33) and the thin film (31) above the trenches (25) are not removed;

removing the insulating layer (27) above the active areas to expose the mask layer (23);

removing the screen layer (33) to expose the thin film (31) above the trench;
removing the thin film (31) above the trenches (25) to expose the insulation layer (27);
and
removing the mask layer (23) above the active region. (See Figs. 2-10).

With respect to claim 2, the insulating layer (27) of Kuehne includes a silicon oxide.

With respect to claim 3, the thin film (31) of Kuehne includes a silicon nitride.

With respect to claim 6, the screen layer (33) of Kuehne includes a photoresist.

With respect to claim 7, the process of Kuehne further includes forming a pad oxide layer (22) on the substrate under the mask layer (23).

With respect to claim 8, as best understood by the examiner, Kuehne teaches a method for forming a shallow trench isolation structure substantially as claimed including:

providing a substrate (21) comprising a plurality of trenches (25) and plurality of active areas, wherein the active areas are covered by a pad oxide layer (22) and a mask layer (23);

forming an insulation layer (27) in the trenches (25) and on the mask layer (23), wherein the insulation layer (27) in the trench (25) has a surface higher than the surface of the substrate (21) and lower than the surface of the mask layer (23);

forming a thin film (31) on the insulation layer (27) above the active areas and the trenches (25), wherein the thin film is conformally formed on the insulation film;

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forming a screen layer (33) on the thin film (31) by a fluid precursor, wherein the thickness of the screen layer formed above the active areas is thinner than the thickness of the screen layer formed above the trenches (25);

removing the screen layer (33) and the thin film (31) above the active areas, while the screen layer (33) and the thin film (31) above the trenches (25) are not removed;

removing the insulating layer (27) above the active areas;

removing the screen layer (33) above the trench;

removing the thin film (31) above the trenches (25); and

removing the mask layer (23) above the active areas. (See Figs. 2-10).

The thickness of the screen layer (33) formed above the active areas is thicker on the trenches than on the active areas appears to be inherent of the spinning step performed after depositing the screen layer (photoresist 33).

With respect to claim 9, the insulating layer (27) of Kuehne includes a silicon oxide.

With respect to claim 10, the thin layer (31) of Kuehne includes a silicon nitride.

With respect to claim 13, the screen layer (33) of Kuehne includes a photoresist.

With respect to claim 14, Kuehne teaches a method for forming a shallow trench isolation structure, applicable to a substrate having at least an active area on the substrate (21), at least a trench (25) surrounding the active area and a pad oxide layer (22) and a mask layer (23) formed sequentially on the substrate (21) in the active areas, as claimed including:

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forming an insulation layer (27) in the trenches (25) and on the mask layer (23), wherein the insulation layer (27) in the trench has a thickness ranged between a sum of the depth of the trench and a thickness of the pad oxide and a sum of the depth of the trench plus a thickness of both the mask layer and the pad oxide layer;

forming a thin layer (31) on the insulation layer (27);

forming a screen layer (33) on the thin layer (31) above the trenches (25);

removing the thin layer (31) above the mask layer (23) and above the active areas, while the screen layer (33) and the thin layer (31) above the trenches (25) are not removed;

removing the insulating layer (27) above the mask layer (23) ;

removing the screen layer (33) above the trenches;

removing the thin layer (31) above the trenches; and

removing the mask layer (23) above the active areas. (See Figs. 2-10);

With respect to claim 15, the insulating layer (27) of Kuehne includes a silicon oxide.

With respect to claim 16, the thin layer (31) of Kuehne includes a silicon nitride.

With respect to claim 19, the screen layer (33) of Kuehne includes a photoresist.

With respect to claim 20, as best understood by examiner, the insulation layer (27) of Kuehne is formed by controlling an etch/deposition ratio of a HDP-CVD.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walsh '741 as applied to claim 1 above, and further in view of Breiten et al. (U.S. Patent No. 4,836,885).

With respect to claim 4, Walsh teaches forming a thin film (50) on the insulation layer (40).

Thus, Walsh is shown to teach all the features of the claim with the exception of including an alternative material for the thin film (50).

However, Breiten teaches a variety of materials can be used for the thin film (25) including nitride or polysilicon.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the thin film (50) of Walsh using polysilicon as taught by Breiten because polysilicon also provides for a similar etch selectivity to the insulation layer (40) as that of nitride material (50).

With respect to claim 7, the method of Breiten further includes forming a pad oxide (13) layer on the substrate (11) under the mask layer (15).

5. Claims 4, 5, 11, 12, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuehne '975 as applied to claim 1 above, and further in view of Breiten '885.

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With respect to claims 4, 11 and 17, Kuehne teaches forming a thin film (31) on the insulation layer (27), thus Kuehne is shown to teach all the features of the claim with the exception of including an alternative material for the thin film (31).

However, Breiten teaches a variety of materials can be used for the thin film (25) including nitride or polysilicon.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the thin film (31) of Kuehne using polysilicon as taught by Breiten because polysilicon also provides for a similar etch selectivity to the insulation layer (27) as that of nitride material.

With respect to claims 5, 12 and 18, the screen layer (27) of Breiten comprises a spin-on-glass or a photoresist.

6. Claims 8-13 are further rejected under 35 U.S.C. 103(a) as being unpatentable over Breiten '885 in view of Kuehne '975.

As best understood by examiner, Breiten teaches a method for forming a shallow trench isolation structure substantially as claimed including:

providing a substrate (11) comprising a plurality of trenches (17) and a plurality of active areas, wherein the active areas are covered by a pad oxide layer (13) and a mask layer (15);

forming an insulation layer (23) in the trenches (17) and on the mask layer (15), wherein the insulation layer on the mask layer (15) has vertical sidewalls;

forming a thin film (25) on the insulation layer above the active areas and the trenches, wherein the thin film (25) formed on the vertical sidewalls of the insulation layer (23);

forming a screen layer (27) on the thin film (25) by a fluid precursor, wherein the thickness of the screen layer formed above the active areas is thinner than the thickness of the screen layer formed above the trenches (17);

removing the screen layer (27) and the thin film (25) above the active areas, while the screen layer (27) and the thin film (25) above the trenches (17) are not removed;

removing the insulating layer (23) above the active areas;

removing the screen layer (27) above the trenches (17); and

removing the thin film (25) above the trenches (17). (See Figs. 2a-f).

Thus, Breiten is shown to teach all the features of the claim with the exception of explicitly disclosing the thickness of the insulation layer (23) formed in the trenches (17) is higher than the surface of the substrate (11) and lower than the surface of the mask layer (15) and removing the mask layer above the active regions.

However, Kuehne teaches forming the insulation layer (27) in the trenches (25), wherein the insulation layer (27) has a surface higher than a surface of the substrate (21) and lower than a surface of the mask layer (23) and removing the mask layer (23). (See Figs. 2-10).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the insulation layer (23) of Breiten to have the thickness as taught by Kuehne because a planar surface can easily obtain with minimal process steps and removing the mask so that the active device can be formed on the active regions.

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With respect to claim 9, the insulating layer (23) of Breiten includes a silicon oxide.

With respect to claims 10 and 11, the thin film (25) of Breiten includes a silicon nitride or polysilicon layer.

With respect to claims 12 and 13, the screen layer (27) of Breiten includes a spin-on-glass layer or photoresist layer.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
August 29, 2002


Olik Chaudhuri
Supervising Patent Examiner
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